

ABSTRACTS OF OTHER PAPERS AND POSTERS PRESENTED AT THE SYMPOSIUM.

Faecal pellets and food habits of chitons (Polyplacophora: Mollusca).

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The faecal pellets of chitons are shed in the forms of spheroid, ovoid or ellipsoid with no surface sculpturings. They are quite simple in external characteristics, but show to some extent generic or specific differences in proportion of length to breadth of the pellets. Clear-cut distinction is demonstrated between the pellets shed by carnivorous mopalids and those of debris feeding chiton groups.

Mapping of the radula of chitons (Mollusca: Polyplacophora) using X-ray micro analysis: a preliminary report.

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It is generally known that the black cusp of the major lateral radula teeth of chitons contains large amounts of iron. This is easily verified by keeping a magnet close to the radula. In this study the radula of *Katharina tunicata* (Wood, 1815) was prepared for X-ray microanalysis to analyze the present elements.

The radula, which was initially air dried, was cleaned in aqua dest using ultrasonic sound waves. Two lateral teeth were dissected and mounted on an adhesive carbon tape. The samples were sputtercoated with a thin layer of carbon and examined in a scanning electron microscope (Philips 252 SEM) at an accelerating voltage of 15 kV. For identification of the elements, X-ray microanalysis was performed with a Tracor Northern X-ray microanalyser connected to the SEM. A mapping for the elements iron and aluminium of both sides of the black cusp of the lateral tooth was performed using the VOYAGER image processing package.

The presence of iron was evidently confirmed and the presence of other elements were below the detection level for match-identification by the program. The mapping indicated that iron was uniformly distributed over the cusp. Aluminium was only slightly more indicated in the cusp as compared to the background. This

technique offers an advanced opportunity to examine various tissues of a species on the presence of different elements.

The laboratory for Electron Microscopy, University of Leiden is greatly acknowledged for the use of SEM and X-ray microanalysis equipment.

Brooding characteristics of *Chiton aorangi*.

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New Zealand.

Chiton aorangi is a small (up to 12 mm long), species that has been collected to date from only 4 widely-separated offshore islands in northern New Zealand. On these wave-exposed islands, it replaces the widespread, mainland species *Chiton pelliserpentis* in mid-intertidal habitats. *C. pelliserpentis* is a large (up to 50 mm long) broadcast spawner, but *C. aorangi* is a brooder. Brooding female *C. aorangi* can be found at all times of the year. Between 16 and 50 large eggs (0.4 mm diameter) are brooded, and development within the pallial grooves progresses right through to 8-plated, crawling juveniles in approximately 16 days. As a result, *C. aorangi* has a highly clumped distribution pattern on a localised scale, with many juveniles clustered around a few adults. The reproductive pattern of *C. aorangi* is compared to other brooding chitons, and the problems of effective dispersal to other localities are discussed.

Abundance patterns of chitons in northeastern New Zealand.

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Seventeen species of chiton are commonly encountered in shallow water areas of northern New Zealand. Quantitative surveys of intertidal and subtidal habitats revealed that 3 species were exclusively intertidal. Four were exclusively subtidal and 10 could be found in either region. Abundances were highest in areas of loose cobbles, where densities often exceeded 200 chitons per m². Here, *Ischnochiton maorianus* accounted for over 50% of the total chiton fauna at all heights on the shore and at depths down to 15 m subtidally. With the exception of *Amaurochiton glaucus*, which usually reached peak abundance in water <5m deep, all species were patchily distributed with no consistent depth-related patterns in abundance. It is concluded that most of these species of chiton are generalist grazers, and that their local abundance patterns reflect chance episodes of recruitment.

Controlled deposition of minerals in chiton radula teeth.

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Both iron (as magnetite, lepidocrocite and goethite) and calcium (as apatite) biominerals are found in architecturally discrete compartments in the teeth of the chiton *Acanthopleura hirtosa*. The various biominerals are laid down on a preformed and complex organic matrix composed of chitin and protein which differs in structure according to where in the tooth it is located. Thus the matrix in the iron (posterior) region consists of relatively sparse fibres while in the calcium (anterior) region the matrix forms a complex pattern of parallel tubules interconnected by fibrous bridges. It is suggested that the structure of the organic matrix both controls the form of the final mineral product and gives mechanical properties to the tooth which enable it to form an effective structure for the excavation of hard substances.

Neurosecretion plays the predominant role in the nervous system of chitons.

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The nervous system of chitons is very primitive among the molluscs; it consists mainly of four primitive cords which are connected around the head and behind the anus by larger nerve cords and in between by numerous nerves. Ganglionic swellings in the radular region do not differ in their structure and ultrastructure from the large cords. Unambiguous ganglia do not exist. There are also no indications of segmentation in the nervous system of chitons. This observation is especially important in the controversial discussion on segmental ancestors of the molluscs.

In all parts of the nervous system there are larger and smaller nerve profiles. The larger ones are filled with various neurosecretory vesicles. The smaller ones run in groups towards the different organs. A system of gliointerstitial cells links the nerve endings with e.g. muscle cells, sensory epithelial cells and other tissues. The most puzzling feature is the absence of any junction-like structures, either among the muscle cells themselves or, most important, between muscle and nerve cells. Especially the "fast muscle" cells are isolated from each other by collagenous sheets. No nerve process, even no process of the gliointerstitial system which is discussed to mediate between the nervous system and other organs was found within the fast muscle. No structural indications for true synaptic contacts have

been found within the nervous system as well as to other cells even in serial sections of larger areas.

These unusual ultrastructural findings give a hint for the dominant role of neurosecretion in chitons. It has been proposed that neurosecretion was the initial function of neurons. In this case, the chitons retained also functionally a very original type of nervous system.

Redefinition of *Notoplax* H. Adams, 1861, and recognition of *Pseudotonicia* Ashby, 1928.

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The genus *Notoplax* is redefined, and restricted in definition from the broad sense previously used by recent authors. *Notoplax* s.s. appears to be restricted to Australia and New Zealand.

The monotypic genus *Pseudotonicia*, endemic to New Zealand, which was previously considered a synonym of *Notoplax*, is recognised as a distinct genus and defined. The sole member of this genus, *P. cuneata*, is reviewed and redescribed, and its habitat given. Similarities between *Pseudotonicia* and the Australian genus *Bassethullia* are discussed.

Valve & girdle structure in the chiton *Pseudotonicia cuneata* (Acanthochitonidae).

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Light and scanning electron microscopy of the valve and girdle structures of the chiton *Pseudotonicia cuneata* is presented. An unusual girdle structure is reported in which the spicules are arranged around the periphery of sub-surface vacuolated cavities of uncertain function. The general structure of the valves is described together with the distribution of the different types of aesthete channels.

Plio-Pleistocene chitons (Mollusca: Polyplacophora) of southern Florida.

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Nearly 1,600 loose chiton valves have been examined from strata ranging in age from 3.5-3.0 m.y. (middle Pliocene) to 1.7-1.0 m.y. (early Pleistocene) in southern Florida. The specimens represent 14 species in the genera *Callistochiton* (1), *Ischnochiton* (3), *Stenoplax* (1), *Chaetopleura* (1), *Tonicia* (1), and *Acanthochitona* (5), as well as a single valve of unknown affinity. Representatives of all of the named genera also occur in the Recent fauna of Florida. Three of the four species that are numerically dominant as Pliocene fossils are also common in the Recent fauna, but most of the other species are undescribed, suggesting that they perished during the several extinction events near the Pliocene-Pleistocene boundary that so changed the Florida fauna.

Grazing effects of a chiton on sessile organisms.

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To examine the grazing efficiency of the chiton, *Acanthopleura japonica*, on sessile organisms, laboratory and field experiments were carried out. In aquarium, grazing abilities of the chitons were estimated by the number of barnacles dislodged per day. It was revealed that larger chitons tend to graze and bulldoze more barnacles. In the field, density and size of the chiton were manipulated by caging. Under higher pressure of grazing (increase in density and/or size of the chiton), abundance of sessile organisms had a tendency to decrease. But under moderate degree of grazing, competitively inferior species increased. The chiton grazing is regarded as one of the organizing factors of rocky shore communities.

The low-shore algal community: an experimental study of grazing by chitons.

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The low-shore algal community along the rocky intertidal shores of New South Wales is dominated by foliose macroalgae, solitary ascidians and the macroalgal

grazing chitons *Plaxiphora albida* and *Onithochiton quercinus*. The effects of grazing by these large, abundant chitons was evaluated by monitoring the changes to the community following their experimental removal. On a large spatial scale, the changes were limited to an increase in the combined cover of macroalgae. On a small spatial scale, the cover of macroalgae increased markedly in the experimental areas compared to the controls. However, these changes were restricted to the tunics of *Pyura* and the substratum immediately surrounding these ascidians. The role of herbivory as a structuring force in this community are discussed in light of these results.

On the type of arrangement of gills and the shape of processes of the chorion in chitons of the Order Chitonida.

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Only species having one gill behind the nephridiopore should be regarded as ones with an abanal gill type. All other species which have 3 or more gills behind the nephridiopore belong to the adanal gill type. As a result of a comparison of shape of the chorion processes with the types of gill arrangement, a correlation between these has been revealed. As it turned out, species of the Chitonida with numerous, delicate, long processes of the chorion have adanal type gills, whereas species of the same order with few, large, bulky processes of the chorion have abanal type gills.

Presented by K.L. Gowlett-Holmes.

The Polyplacophora of the Red Sea.

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This paper reviews the Red Sea chiton fauna and discusses the 23 species thus far recorded. One new species is described; *Leptochiton (Parachiton)* n. sp. and one species is new for the Red Sea fauna; *Leptochiton nierstraszi* Leloup.

As far as chitons are concerned, the Red Sea does not constitute a separate zoogeographic entity, but is part of the tropical western Indian Ocean zoogeographical province. Only three species [*L. (P.)* n. sp., *Tonicia (Lucilina) perligera* Thiele and *Acanthochitona mastalleri* Strack] are endemic to the Red sea. Lessepsian migration (from Red Sea to Mediterranean) is a rare phenomenon and only one case [*Chiton (Tegulaplex) hululensis* (E.A. Smith)] has been recorded.

There are no reliable records of antilesepsian migration. All previous records are due to misidentifications by Leloup.

Although the northern Red Sea chiton fauna is now relatively well understood, the chiton fauna from the southern part of the Red Sea remains largely unknown. Only 2% of the studied material originated from that area, therefore we are unable to indicate how many western Indian Ocean species penetrate into the Red Sea and to what extent.

Summary of the results of the Rumphius Biohistorical Expedition.

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In December 1990, the Rumphius Biohistorical Expedition returned after six weeks of marine biological research on Ambon Island (Moluccas, Indonesia). During this expedition one of the largest collections of chitons from Indonesia was made. Some preliminary results will be discussed.

***Triplicatella disdoma* Conway Morris, 1990, reinterpreted as the earliest known polyplacophoran.**

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Triplicatella disdoma from the Lower Cambrian Parara and Ajax Limestones of South Australia, was described as a probable operculum of an undiscovered tubular fossil. The complete absence of any shelly fossil whose aperture *T. disdoma* fits, despite itself being common, makes an opercular function unlikely. Re-examination has led to the interpretation of *T. disdoma* as a chiton, the earliest one known in the world. Three distinct valve morphs can be recognised, with the two presumed terminal valve morphs being much rarer. The valves lack an articulamentum, and do not resemble those of the Paleoloricata. Only preliminary work on *T. disdoma* has been done at this stage.

Spawning periods of three species of *Acanthopleura* in Okinawa, Japan.

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Three intertidal chitons inhabit the same rocky shore of Sesoko Island, Okinawa. They spawn eggs in summer, and their eggs can be distinguished each other by their shapes and colors.

Plankton near the rocky shore was collected 660 times for a month. The eggs of each chiton species appeared in particular and limited periods, which can be identified with their spawning periods.

One spawns around morning high tide, and the others spawn around evening or night high tide. They spawn with daily and semilunar periodicity, and the periods are separated each other. This suggests that they share and yield suitable spawning periods for avoiding sperm contamination.